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Clustering-Based Threshold Model for Condition Rating of Concrete Bridge Decks

Authors : M. Alsharqawi, T. Zayed, S. Abu Dabous

Abstract : To ensure safety and serviceability of bridge infrastructure, accurate condition assessment and rating methods are needed to provide basis for bridge Maintenance, Repair and Replacement (MRR) decisions. In North America, the common practices to assess condition of bridges are through visual inspection. These practices are limited to detect surface defects and external flaws. Further, the thresholds that define the severity of bridge deterioration are selected arbitrarily. The current research discusses the main deteriorations and defects identified during visual inspection and Non-Destructive Evaluation (NDE). NDE techniques are becoming popular in augmenting the visual examination during inspection to detect subsurface defects. Quality inspection data and accurate condition assessment and rating are the basis for determining appropriate MRR decisions. Thus, in this paper, a novel method for bridge condition assessment using the Quality Function Deployment (QFD) theory is utilized. The QFD model is designed to provide an integrated condition by evaluating both the surface and subsurface defects for concrete bridges. Moreover, an integrated condition rating index with four thresholds is developed based on the QFD condition assessment model and using K-means clustering technique. Twenty case studies are analyzed by applying the QFD model and implementing the developed rating index. The results from the analyzed case studies show that the proposed threshold model produces robust MRR recommendations consistent with decisions and recommendations made by bridge managers on these projects. The proposed method is expected to advance the state of the art of bridges condition assessment and rating.

Keywords : concrete bridge decks, condition assessment and rating, quality function deployment, k-means clustering technique
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